



# Reading and Mapping Aerosol Data From a MODIS HDF4 File

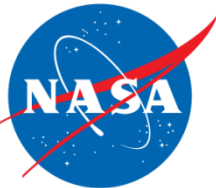
**NASA ARSET**

<http://arset.gsfc.nasa.gov/>

**For Python help, contact:**

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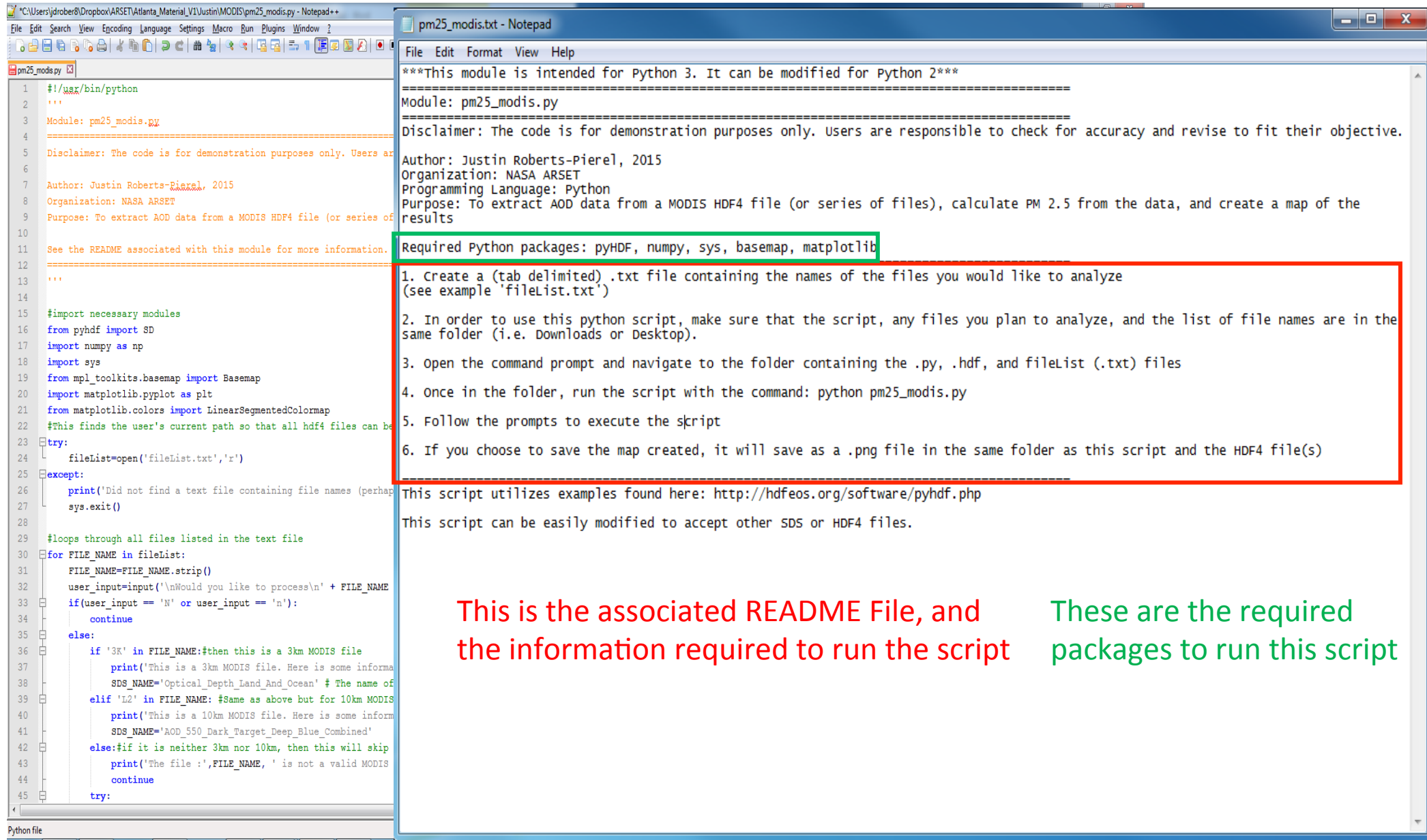


# Mapping AOD Derived PM 2.5 Data

- Objective: Extract AOD data from a MODIS HDF4 file (or series of files), calculate PM 2.5 from the data, and create a map of the results
- This python script will do the following:
  1. Read a text file containing the names of the HDF4 files you are analyzing
  2. Read in each MODIS Aerosol Product L2 HDF4 file
  3. Display information (average, standard deviation, etc.) about AOD in each file. By default it will display the following SDS depending on resolution:
    - MOD04\_L2 (10km) : AOD\_550\_Dark\_Target\_Deep\_Blue\_Combined
    - MOD04\_3K (3km) : Optical\_Depth\_Land\_And\_Ocean
  4. Asks user if they would like to provide a slope and intercept for PM 2.5 calculation. If the user declines, then default values are used:
    - Slope: 40
    - Intercept: 3
  5. Asks user if they would like to see a map of the PM 2.5 data, opens if desired. Once map is closed, asks user if they would like to save the map
    - If desired, saves the map as a .png file with the same name as the HDF4 file
  6. Moves on to the next file in your file list, if applicable

# What you can expect...

This is the python code from the pm25\_modis.py file



The image shows two Notepad++ windows. The left window displays the `pm25_modis.py` script, and the right window displays the `pm25_modis.txt` README file.

**pm25\_modis.py (Left Window):**

```
1 #!/usr/bin/python
2 '''
3 Module: pm25_modis.py
4
5 Disclaimer: The code is for demonstration purposes only. Users are responsible to check for accuracy and revise to fit their objective.
6
7 Author: Justin Roberts-Pierel, 2015
8 Organization: NASA ARSET
9 Purpose: To extract AOD data from a MODIS HDF4 file (or series of files), calculate PM 2.5 from the data, and create a map of the results
10
11 See the README associated with this module for more information.
12
13 '''
14
15 #import necessary modules
16 from pyhdf import SD
17 import numpy as np
18 import sys
19 from mpl_toolkits.basemap import Basemap
20 import matplotlib.pyplot as plt
21 from matplotlib.colors import LinearSegmentedColormap
22 #This finds the user's current path so that all hdf4 files can be
23 try:
24     fileList=open('fileList.txt','r')
25 except:
26     print('Did not find a text file containing file names (perhaps you are not in the correct directory)')
27     sys.exit()
28
29 #loops through all files listed in the text file
30 for FILE_NAME in fileList:
31     FILE_NAME=FILE_NAME.strip()
32     user_input=input('\nWould you like to process\n' + FILE_NAME + '\n')
33     if(user_input == 'N' or user_input == 'n'):
34         continue
35     else:
36         if '3K' in FILE_NAME: #then this is a 3km MODIS file
37             print('This is a 3km MODIS file. Here is some information about the file:')
38             SDS_NAME='Optical_Depth_Land_And_Ocean' # The name of the SDS
39             print('This is a 10km MODIS file. Here is some information about the file:')
40             SDS_NAME='AOD_550_Dark_Target_Deep_Blue_Combined'
41         elif '10' in FILE_NAME: #same as above but for 10km MODIS
42             print('This is a 10km MODIS file. Here is some information about the file:')
43             SDS_NAME='AOD_550_Dark_Target_Deep_Blue_Combined'
44         else: #if it is neither 3km nor 10km, then this will skip
45             print('The file :',FILE_NAME, ' is not a valid MODIS file')
46             continue
47     try:
48         #extract AOD data from the HDF4 file
49         #calculate PM 2.5 from the AOD data
50         #create a map of the results
51         #save the map as a .png file
```

**pm25\_modis.txt (Right Window):**

```
***This module is intended for Python 3. It can be modified for Python 2***
Module: pm25_modis.py
Disclaimer: The code is for demonstration purposes only. Users are responsible to check for accuracy and revise to fit their objective.
Author: Justin Roberts-Pierel, 2015
Organization: NASA ARSET
Programming Language: Python
Purpose: To extract AOD data from a MODIS HDF4 file (or series of files), calculate PM 2.5 from the data, and create a map of the results

Required Python packages: pyHDF, numpy, sys, basemap, matplotlib

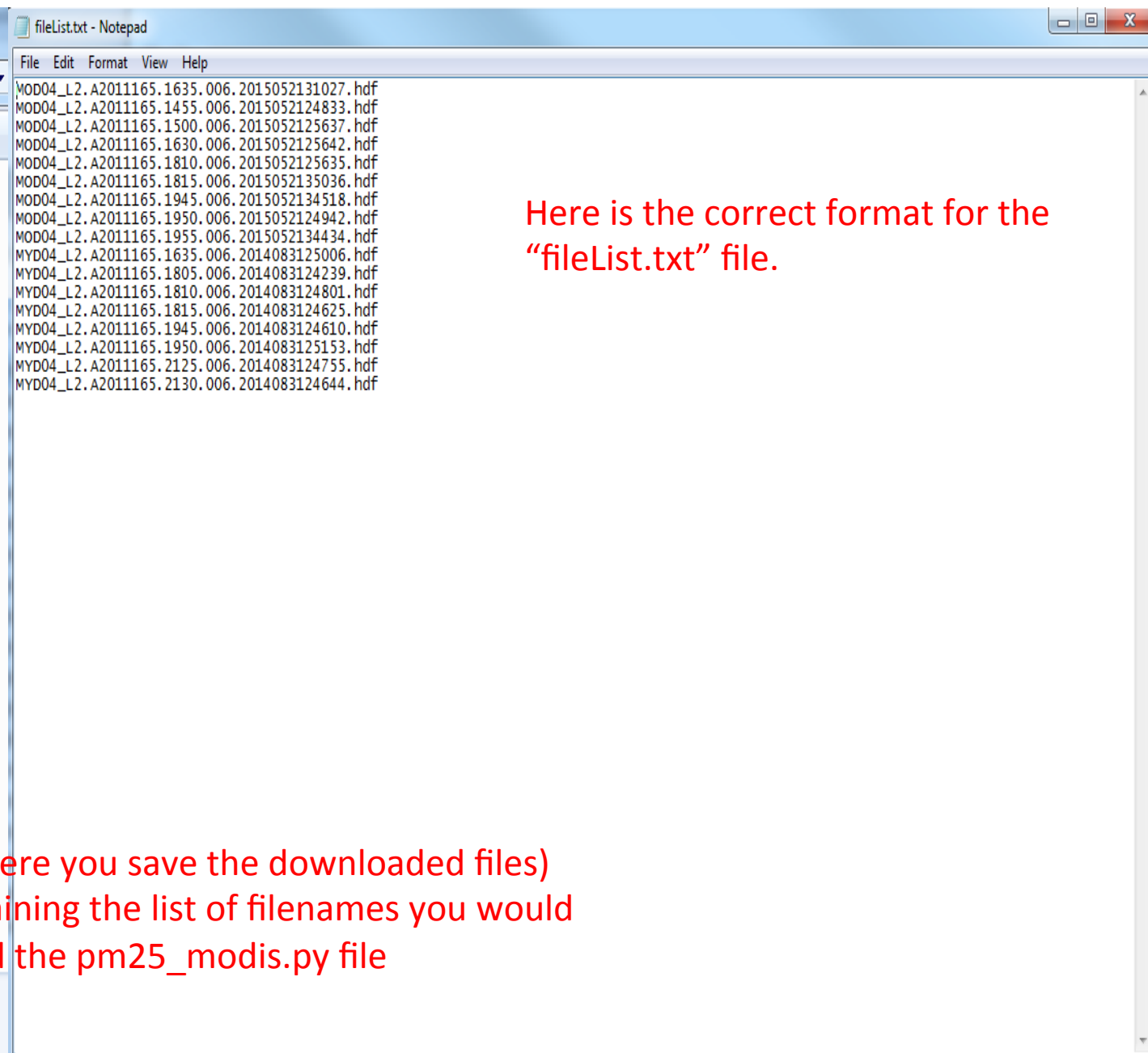
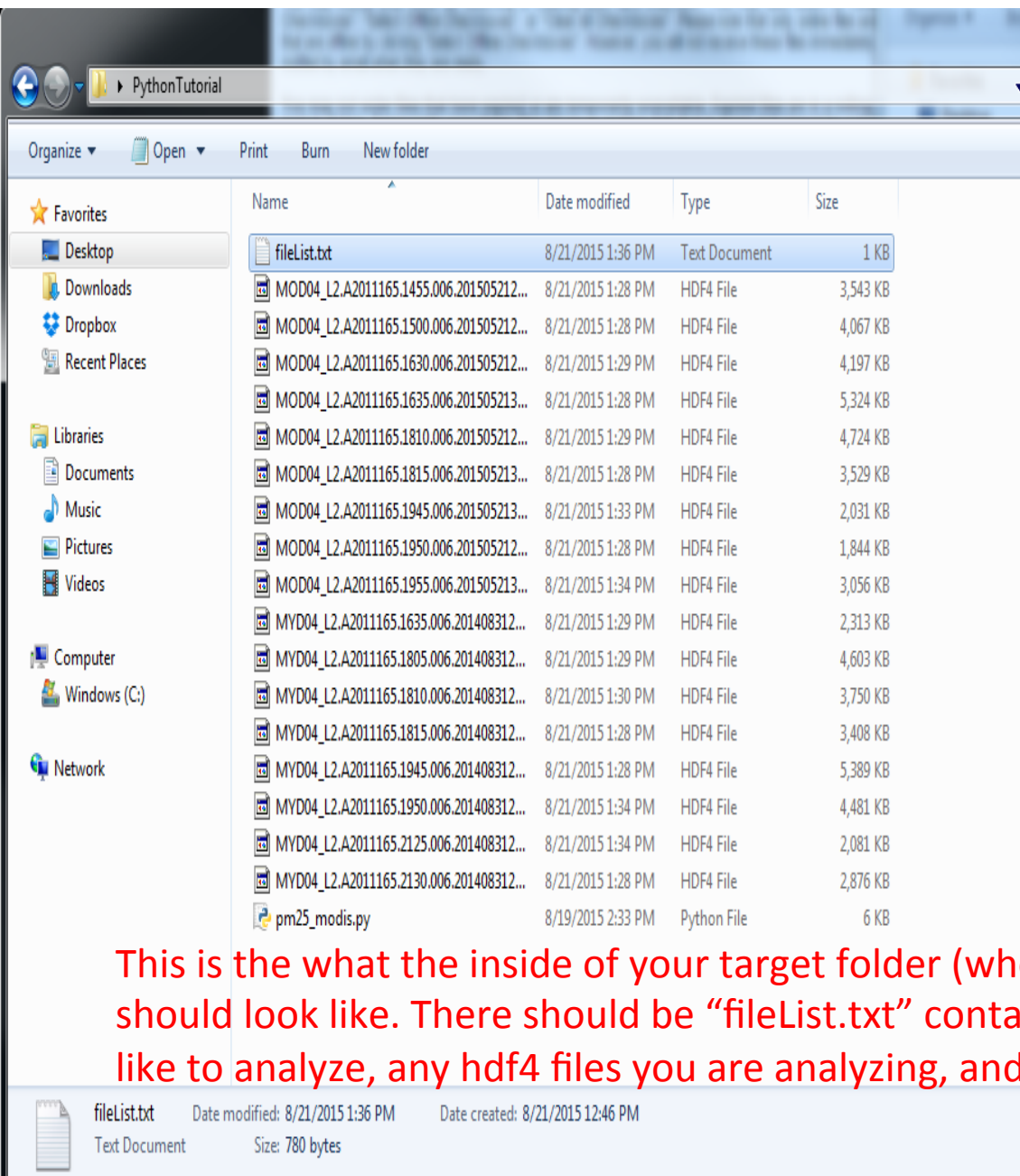
1. Create a (tab delimited) .txt file containing the names of the files you would like to analyze (see example 'fileList.txt')
2. In order to use this python script, make sure that the script, any files you plan to analyze, and the list of file names are in the same folder (i.e. Downloads or Desktop).
3. Open the command prompt and navigate to the folder containing the .py, .hdf, and fileList (.txt) files
4. Once in the folder, run the script with the command: python pm25_modis.py
5. Follow the prompts to execute the script
6. If you choose to save the map created, it will save as a .png file in the same folder as this script and the HDF4 file(s)

This script utilizes examples found here: http://hdfeos.org/software/pyhdf.php
This script can be easily modified to accept other SDS or HDF4 files.
```

This is the associated README File, and the information required to run the script

These are the required packages to run this script

# Folder Contents



Here is the correct format for the “fileList.txt” file.

This is the what the inside of your target folder (where you save the downloaded files) should look like. There should be “fileList.txt” containing the list of filenames you would like to analyze, any hdf4 files you are analyzing, and the pm25\_modis.py file

# Accessing your target folder and viewing the contents

Follow these steps to  
access your target folder  
and view its contents

The command "cd" changes  
your current directory

The command "dir" displays  
the contents of the current  
directory

```
Command Prompt
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\jdrober8>cd Desktop
```

```
Command Prompt
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\jdrober8>cd Desktop
C:\Users\jdrober8\Desktop>cd PythonTutorial
C:\Users\jdrober8\Desktop\PythonTutorial>
```

```
Command Prompt

C:\Users\jdrober8\Desktop>cd PythonTutorial
C:\Users\jdrober8\Desktop\PythonTutorial>dir
Volume in drive C is Windows
Volume Serial Number is 4A07-A5A5

Directory of C:\Users\jdrober8\Desktop\PythonTutorial

08/21/2015  12:46 PM    <DIR>          .
08/21/2015  12:46 PM    <DIR>          ..
08/16/2015  10:41 PM                182 fileList.txt
08/16/2015  10:41 PM      4,998,869 MOD04_3K.A2015091.1750.006.2015092021418.
hdf
08/16/2015  10:40 PM      2,092,649 MOD04_L2.A2011165.1635.051.2011166022132.
hdf
08/16/2015  10:40 PM      1,054,099 MOD04_L2.A2015062.1645.006.2015063024748.
hdf
08/16/2015  10:40 PM      1,665,489 MOD04_L2.A2015085.1650.006.2015086020817.
hdf
08/19/2015   02:33 PM         6,075 pm25_modis.py
               6 File(s)          9,817,363 bytes
               2 Dir(s)  251,994,333,184 bytes free

C:\Users\jdrober8\Desktop\PythonTutorial>python pm25_modis.py
```

# Python file outputs

```
Command Prompt - python pm25_modis.py

Volume Serial Number is 4A07-A5A5

Directory of C:\Users\jdrober8\Desktop\PythonTutorial

08/21/2015  12:46 PM    <DIR>          .
08/21/2015  12:46 PM    <DIR>          ..
08/16/2015  10:41 PM                182 fileList.txt
08/16/2015  10:41 PM    4,998,869 MOD04_3K.A2015091.1750.006.2015092021418.
 hdf
08/16/2015  10:40 PM    2,092,649 MOD04_L2.A2011165.1635.051.2011166022132.
 hdf
08/16/2015  10:40 PM    1,054,099 MOD04_L2.A2015062.1645.006.2015063024748.
 hdf
08/16/2015  10:40 PM    1,665,489 MOD04_L2.A2015085.1650.006.2015086020817.
 hdf
08/19/2015   02:33 PM                6,075 pm25_modis.py
        6 File(s)          9,817,363 bytes
        2 Dir(s)  251,994,333,184 bytes free

C:\Users\jdrober8\Desktop\PythonTutorial>python pm25_modis.py

Would you like to process
MOD04_L2.A2011165.1635.051.2011166022132.hdf

<Y/N>
```

Execute the file using the  
"python" command. After  
executing the file, you will be  
asked if you would like to  
analyze each file in your file list

# Python file outputs

```
C:\> Command Prompt - python pm25_modis.py
08/16/2015 10:40 PM 2,092,649 MOD04_L2.A2011165.1635.051.2011166022132.
hdf
08/16/2015 10:40 PM 1,054,099 MOD04_L2.A2015062.1645.006.2015063024748.
hdf
08/16/2015 10:40 PM 1,665,489 MOD04_L2.A2015085.1650.006.2015086020817.
hdf
08/19/2015 02:33 PM 6,075 pm25_modis.py
6 File(s) 9,817,363 bytes
2 Dir(s) 251,994,333,184 bytes free

C:\Users\jdrober8\Desktop\PythonTutorial>python pm25_modis.py

Would you like to process
MOD04_L2.A2011165.1635.051.2011166022132.hdf
(Y/N)y
This is a 10km MODIS file. Here is some information:
The valid range of values is: -0.1 to 5.0
The average is: 0.205
The standard deviation is: 0.175
The range of latitude in this file is: 16.5796 to 37.5108 degrees
The range of longitude in this file is: -100.566 to -73.2887 degrees
Would you like to enter a slope and intercept for PM 2.5 calculation?
```

Information about the file will be printed, and you will be asked if you would like to provide a slope and intercept for PM 2.5 calculation



# Python file outputs

```
Command Prompt - python pm25_modis.py

hdf
08/16/2015  10:40 PM          1,665,489 MOD04_L2.A2015085.1650.006.2015086020817.
hdf
08/19/2015  02:33 PM          6,075 pm25_modis.py
          6 File(s)          9,817,363 bytes
          2 Dir(s)  251,994,333,184 bytes free

C:\Users\jdrober8\Desktop\PythonTutorial>python pm25_modis.py

Would you like to process
MOD04_L2.A2011165.1635.051.2011166022132.hdf

(Y/N)y
This is a 10km MODIS file. Here is some information:

The valid range of values is: -0.1 to 5.0
The average is: 0.205
The standard deviation is: 0.175
The range of latitude in this file is: 16.5796 to 37.5108 degrees
The range of longitude in this file is: -100.566 to -73.2887 degrees

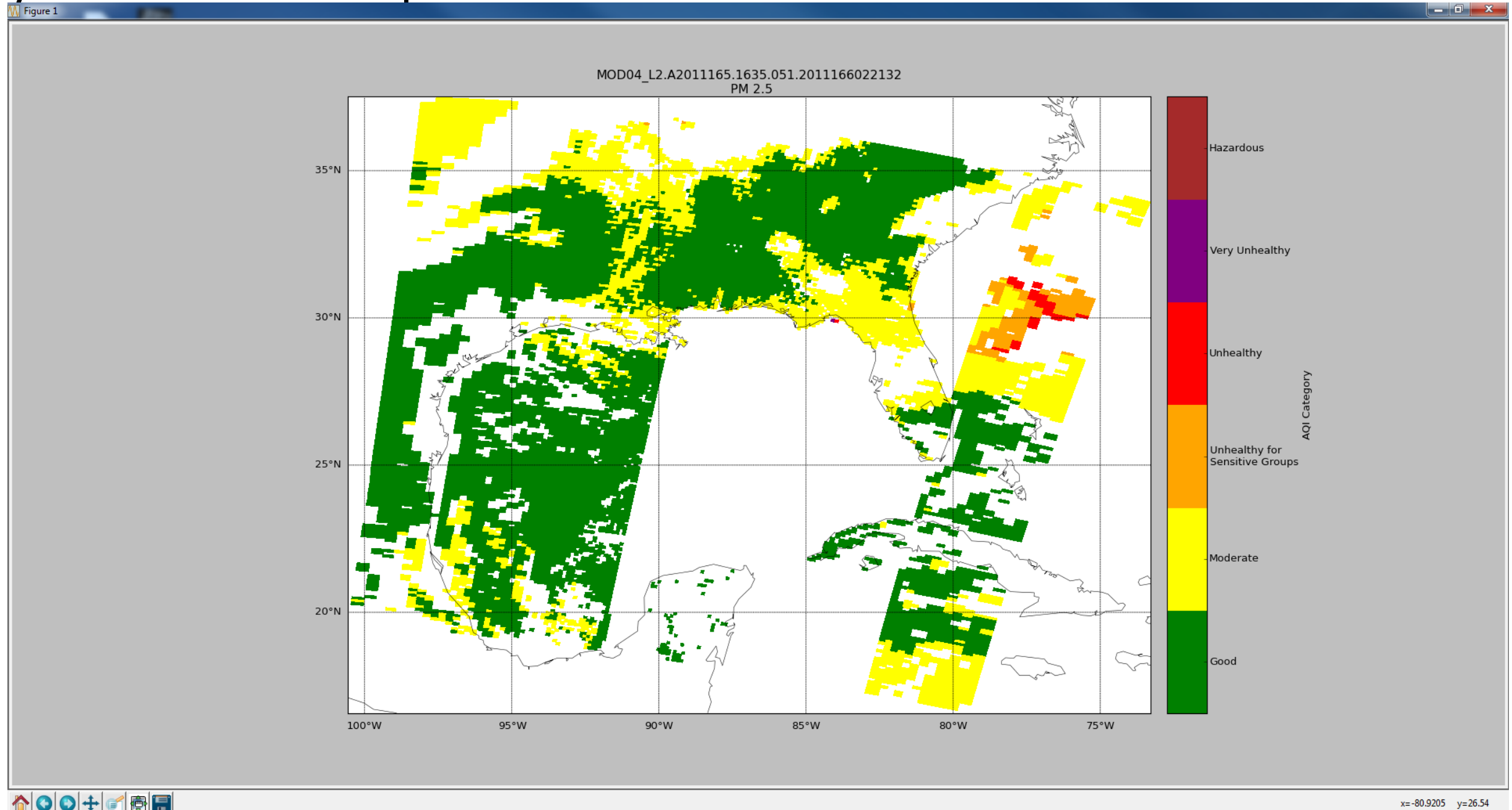
Would you like to enter a slope and intercept for PM 2.5 calculation?n

Would you like to create a map of this data? Please enter Y or N
```

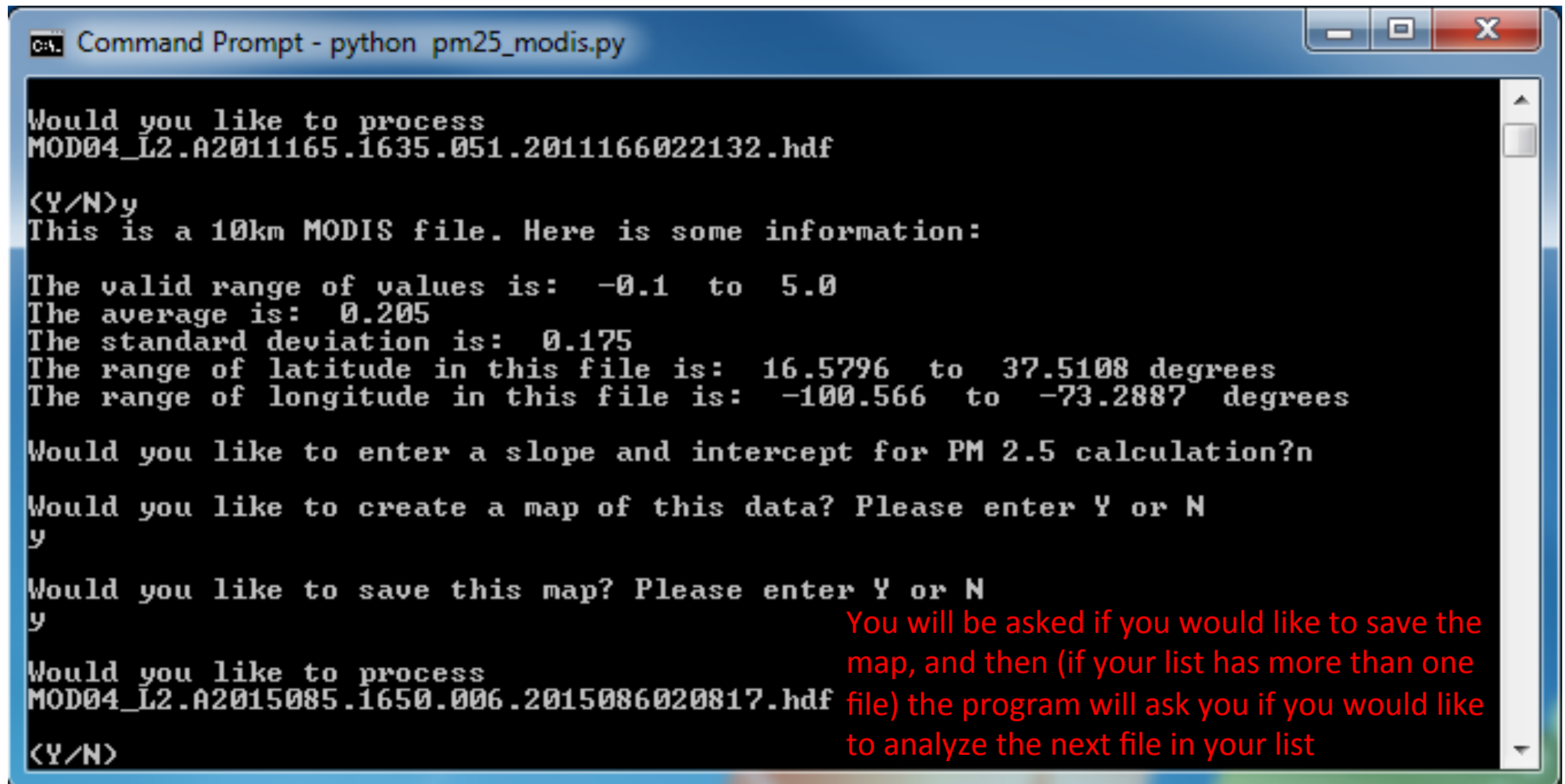
Default values are chosen if you select "No", and then you are asked if you would like to see a map of the resulting data



# Python file outputs



# Python file outputs



```
Command Prompt - python pm25_modis.py

Would you like to process
MOD04_L2.A2011165.1635.051.2011166022132.hdf

<Y/N>y
This is a 10km MODIS file. Here is some information:

The valid range of values is: -0.1 to 5.0
The average is: 0.205
The standard deviation is: 0.175
The range of latitude in this file is: 16.5796 to 37.5108 degrees
The range of longitude in this file is: -100.566 to -73.2887 degrees

Would you like to enter a slope and intercept for PM 2.5 calculation?n

Would you like to create a map of this data? Please enter Y or N
y

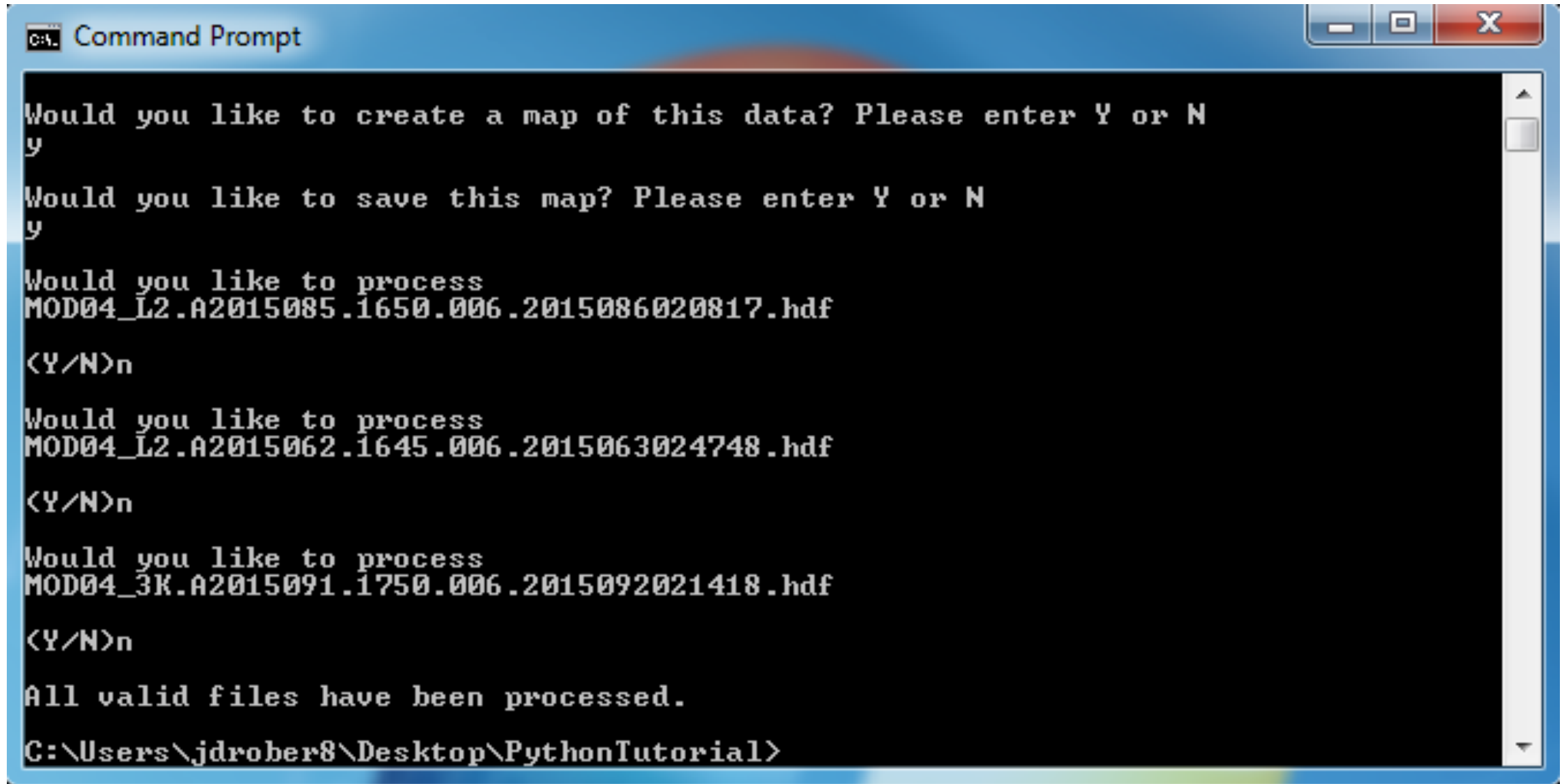
Would you like to save this map? Please enter Y or N
y

Would you like to process
MOD04_L2.A2015085.1650.006.2015086020817.hdf

<Y/N>
```

You will be asked if you would like to save the map, and then (if your list has more than one file) the program will ask you if you would like to analyze the next file in your list

# Python file outputs



```
Command Prompt

Would you like to create a map of this data? Please enter Y or N
y
Would you like to save this map? Please enter Y or N
y
Would you like to process
MOD04_L2.A2015085.1650.006.2015086020817.hdf
<Y/N>n
Would you like to process
MOD04_L2.A2015062.1645.006.2015063024748.hdf
<Y/N>n
Would you like to process
MOD04_3K.A2015091.1750.006.2015092021418.hdf
<Y/N>n
All valid files have been processed.
C:\Users\jdrober8\Desktop\PythonTutorial>
```

# Python file outputs

